Highest Level of Inverter

FR-A700

series is now available!

Mitsubishi Electric Corporation Nagoya Works
Inverter system department

Model configuration

◆Inverter type

FR – A720 – 0.4K

Symbol	Voltage
2	200V class
4	400V class

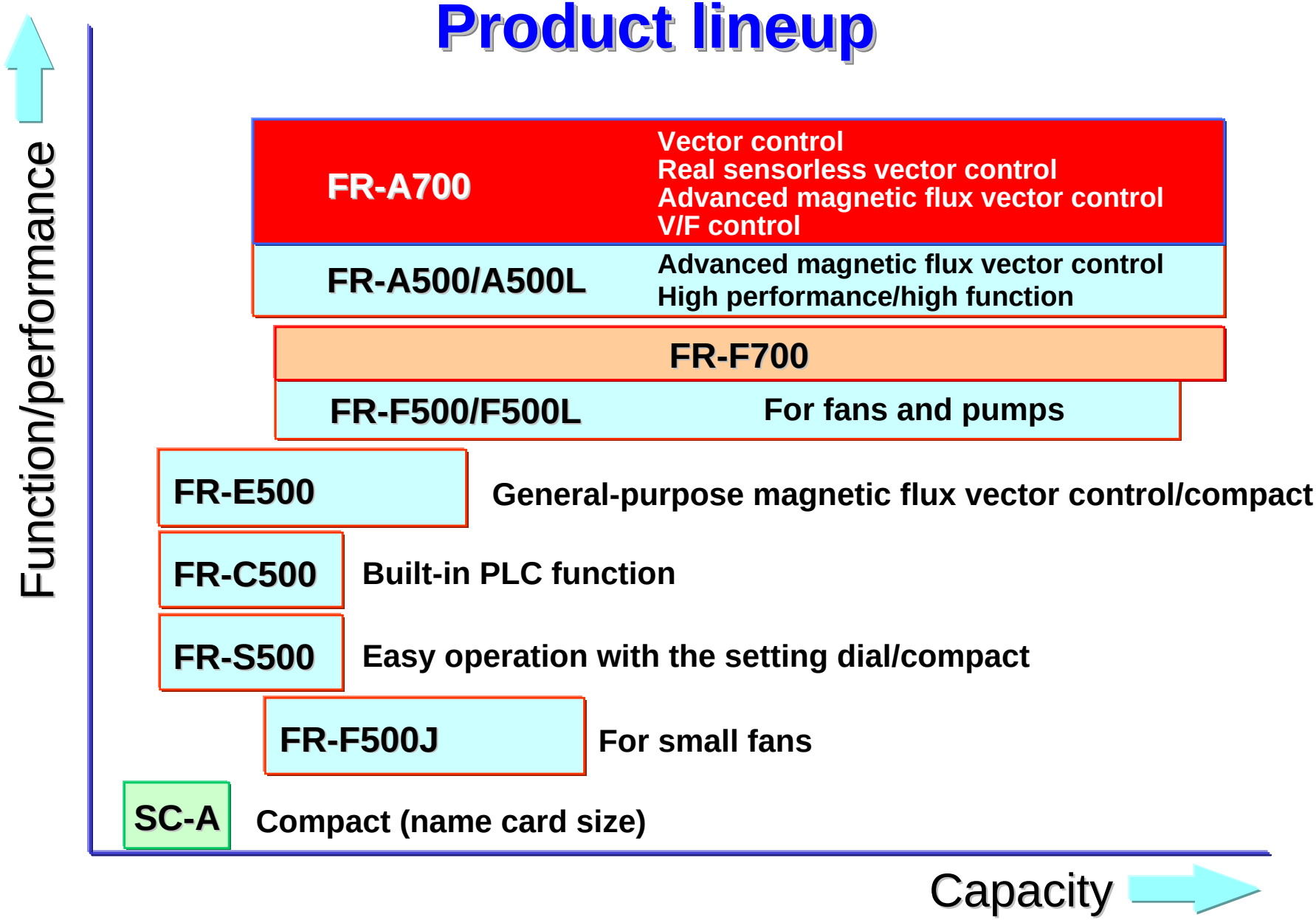
Symbol	Inverter Capacity
0.4K to 500K	Indicate capacity (kW)

◆Model lineup

Three-phase 400V class FR-A740-□□	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Three-phase 200V class FR-A720-□□	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	–	–	–	–	–	–	–	–	–	–	–	–	–
Applied motor (kW)	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	185	220	250	280	315	355	400	450	500

●: Available models ○: Models to be released –: Not available

Product lineup



General specifications

●200V class

Type FR-A720-□□K			0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Applicable motor capacity (kW)			0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Output	Rated capacity (kVA)		1.1	1.9	3.1	4.2	6.7	9.2	12.6	17.6	23.3	29	34	44	55	67	82
	Rated current (A)		3	5	8	11	17.5	24	33	46	61	76	90	115	145	175	215
	Overload current capacity		150% 60s, 200% 3s (inverse-time characteristics) Ambient temperature 50℃														
	Voltage		Three-phase, 200 to 240V														
	Regener-ative braking torque	Maximum value/ Permissible duty	150% torque/3%ED			100% torque/ 3%ED		100% torque/ 2%ED		20% torque/continuous							
Power supply	Rated input AC voltage, frequency		Three-phase, 200V to 220V 50Hz, 200 to 240V 60Hz														
	Permissible AC voltage fluctuation		170 to 242V 50Hz, 170 to 264V 60Hz														
	Permissible frequency fluctuation		±5%														
	Power supply system capacity (kVA)		1.5	2.5	4.5	5.5	9	12	17	20	28	34	41	52	66	80	100
Protective structure (JEM 1030)			Enclosed type (IP20)											Open type (IP00)			
Cooling system			Self-cooling	Forced air cooling													

Features

1.Highest level of driving performance
2.Long life parts and life check function
3.Network connection as you desired
4.Free of environmental worries
5.Simple operation and easy maintenance
6.Improved usability with full of useful functions
7.Global compliance

1.Highest level of driving performance

(1) Exhibit best performance of the general-purpose motor (real sensorless vector control)

Real sensor less vector control

High accuracy/fast response speed operation by the vector control can be performed with a general-purpose motor without encoder.

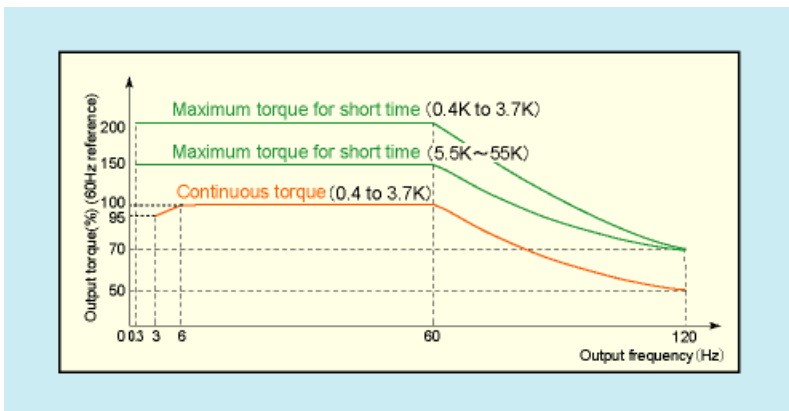
- Maximum of 200% high torque can be generated at an ultra low speed of 0.3Hz (0.4K to 3.7K).
- Torque control operation is also available.* (torque control range 1:20, absolute torque accuracy ±20%, repeated torque accuracy ±10%)

*Since torque control can not be performed in the low speed regeneration region and at a low speed with light load, use the vector control with encoder .

- Response level has been improved.

Speed control range 1:200 (only at 0.3 to 60Hz power driving)

Speed response 120rad/s

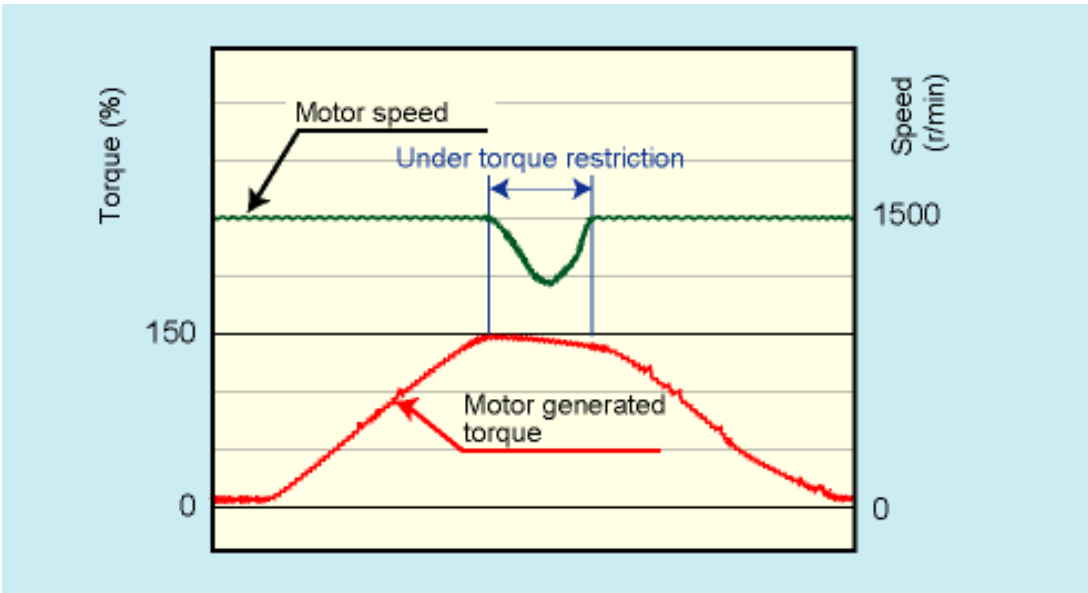


Torque characteristic under real sensorless vector control
Start-time tuning selection when the motor SF-JR 4P is used (at 220V input)

1.Highest level of driving performance

1) Torque restriction ensures safety even during speed control

Torque restriction function is effective to prevent machine from damage (prevention against damage of grinding machine tools, etc.) against the sudden disturbance torque.

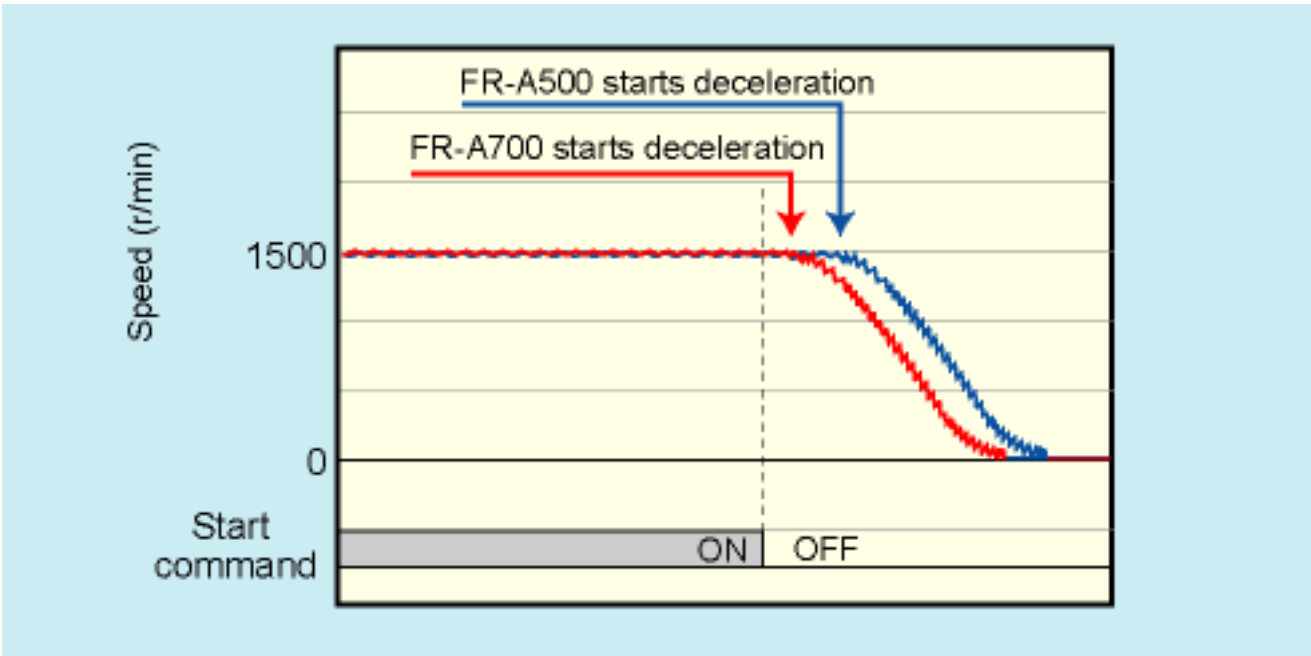


Example of torque restriction characteristic
When the motor SF-JR 4P 3.7kW is used

1.Highest level of driving performance

2) Improvement of terminal response

The delay to the terminal command has been minimized.
The response time has been reduced to half as compared to the conventional model (FR-A500).
It is suitable for cycle-operation applications.

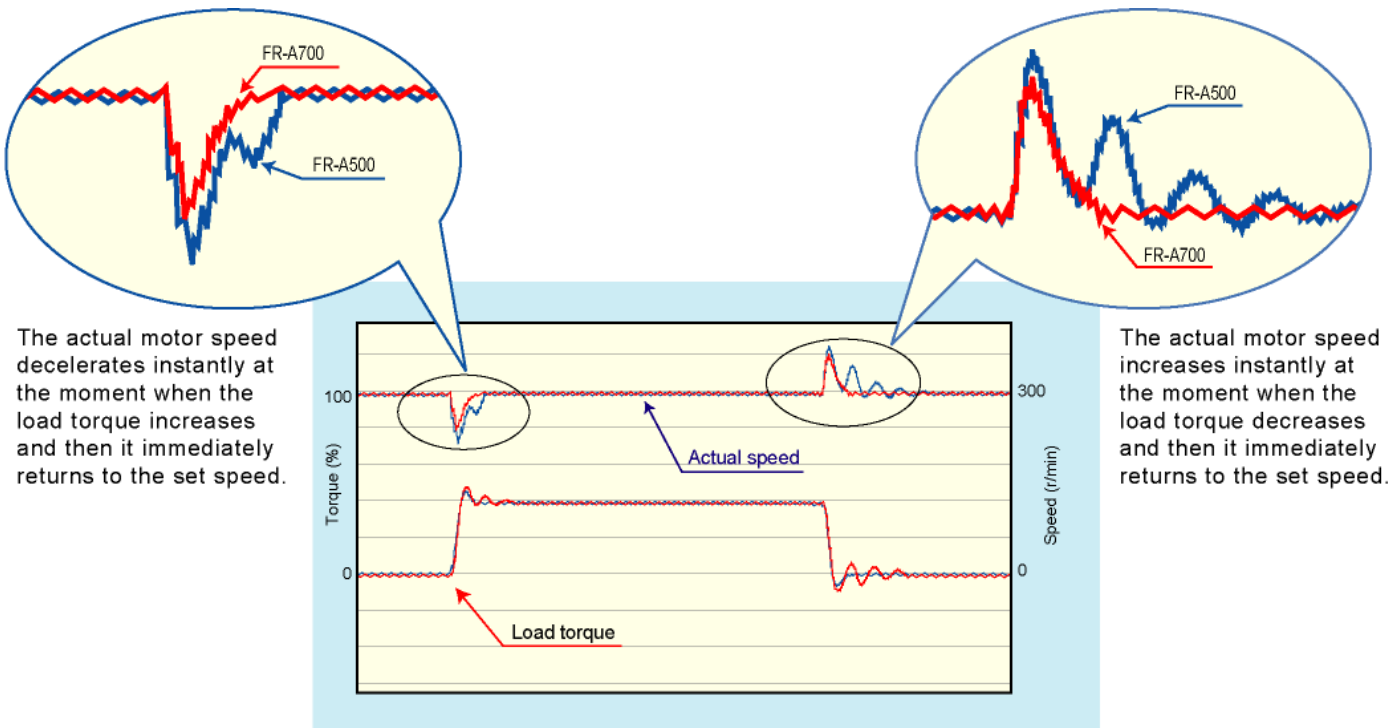


Terminal response characteristic example

1.Highest level of driving performance

3) Quick response to the sudden load fluctuation

Torque response level to the sudden load fluctuation has been greatly improved as compared to the conventional model.
The motor speed variation is minimized to maintain a constant speed.
It is suitable for a sawmill machine, etc.



Example of actual speed variation when an impact load is connected
FR-A700 series under real sensorless vector control
FR-A500 series under advanced magnetic flux vector control

1.Highest level of driving performance

(2) Higher accuracy operation is realized with a motor with encoder (vector control)

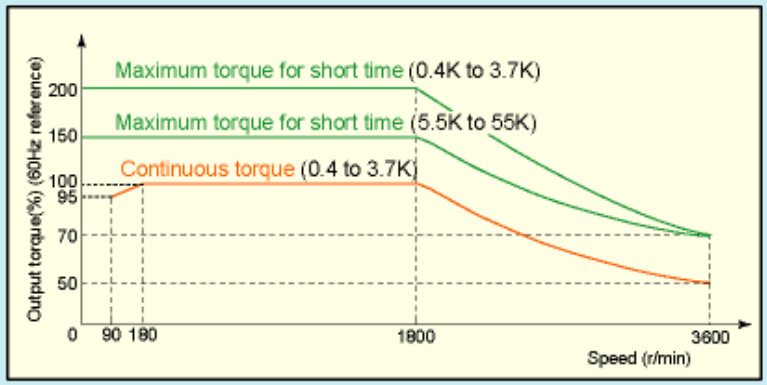
Full-scale vector control operation can be performed using a motor with encoder*1.
Torque control/position control as well as fast response/high accuracy speed control (zero speed control, servo lock) can be realized with the inverter.

*1 It is necessary to connect to the plug-in option for encoder feed back control (FR-A7AP)

1.Highest level of driving performance

● Speed control

Speed control range 1:1500
(both power driving/regeneration*2)
Speed variation ratio ±0.01%
(to the speed of 3000r/min)
Speed response 300rad/s
(with model adaptive speed control)



Torque characteristic under vector control
When the motor with encoder, SF-JR4P, is used (at 220V input)

● Torque control

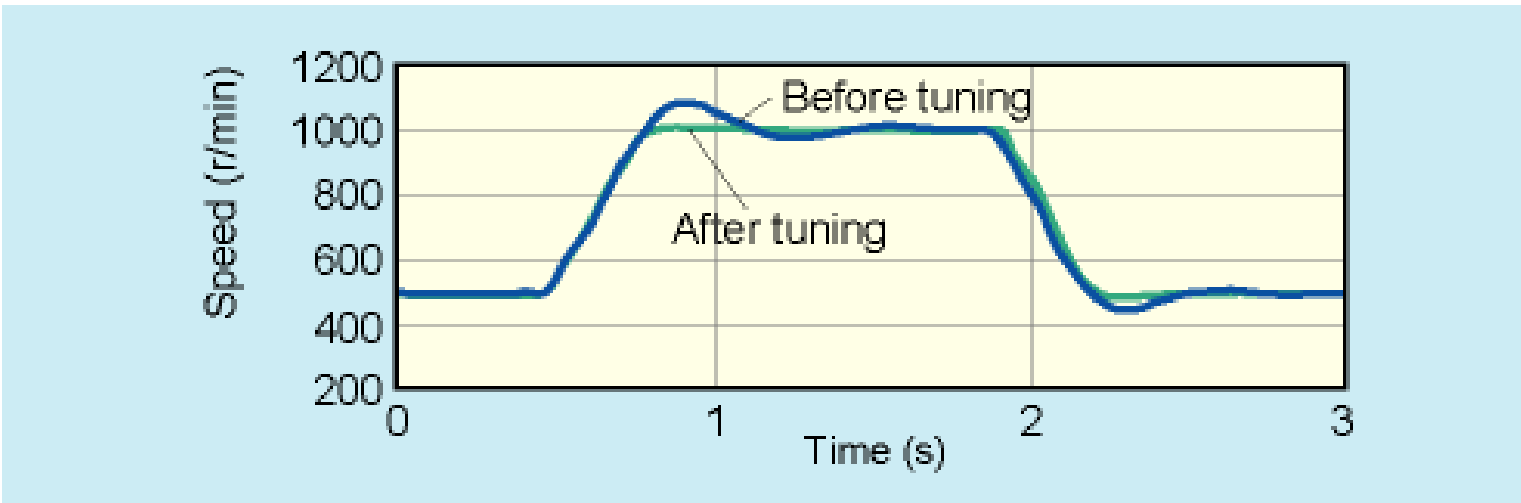
Torque control range 1:50
Absolute torque accuracy ±10%*3
Repeated torque accuracy ±5%*3

*2 Regeneration unit (option) is necessary for regeneration.
*3 Online auto tuning (with adaptive magnetic flux observer)

1.Highest level of driving performance

1) Easy gain tuning

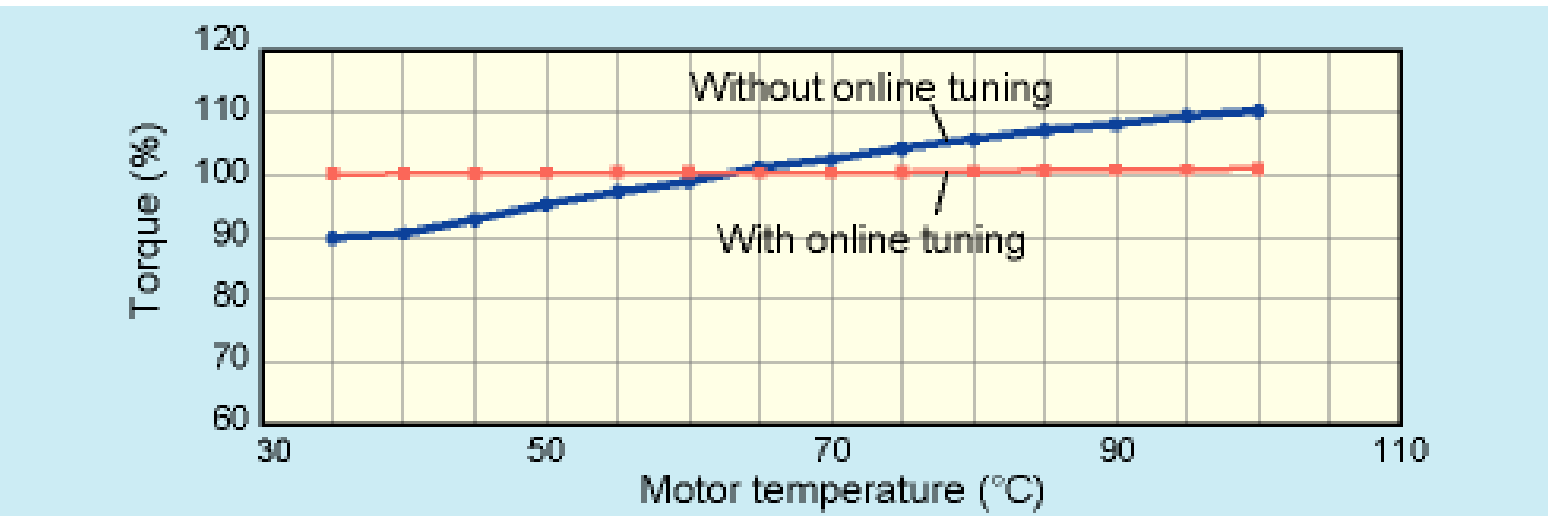
Since the load inertia of the motor is automatically estimated online to calculate the optimum speed control gain and position loop gain, gain adjustment is easily done.
This control is appropriate for a cycle operation under speed control and position control.



Comparison of the speed accuracy
before and after the load inertia estimation

2) High accuracy torque control operation with online auto tuning

Operation with high torque accuracy less susceptible to the temperature change of the motor second resistance is realized with online tuning (adaptive magnetic flux observer). This operation is appropriate for applications such as a winder/printing machine (tension control) which is controlled by torque.



Example of motor temperature-torque characteristics

1.Highest level of driving performance

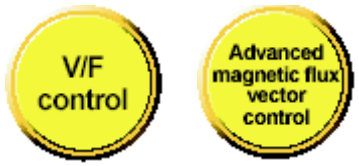
3) Vector control dedicated motor

From low speed to 100% of the continuous operation torque is generated if a vector control dedicated motor is used.
It is suitable for winder and unwinder applications.
As motors with speed ratio of 1:2, 1:3, and 1:4 specifications are available, they can accommodate applications whose winding diameter greatly changes.
Decreasing the rated speed will increase the rated torque, so you can select a motor with smaller capacity.
(The inverter capacity needs to be one to three ranks higher than the motor capacity.)

● Lineup of vector control dedicated motors

Type	Specifications	Motor Capacity
SF-V5RU	1500r/min	1.5kW to 55kW
SF-V5RU1	1000r/min Speed ratio1:2	1.5kW to 37kW
SF-V5RU3	1000r/min Speed ratio1:3	1.5kW to 30kW
SF-V5RU4	500r/min Speed ratio1:4	1.5kW to 15kW
SF-THY	1500r/min	75kW to 250kW

1.Highest level of driving performance



(3) V/F control and advanced magnetic flux vector control operations are also available

Since V/F control and advanced magnetic flux vector control operations are also available, you can replace the conventional model (FR-A500 series) without anxiety.

Complement: list of functions according to the driving control system

Control System	Speed Control	Torque Control	Position control	Speed Control Range	Speed Response	Applied Motor
V/F	○	×	×	1:10 (6 to 60Hz:Driving)	10 to 20rad/s	General-purpose motor (without encoder)
Advanced magnetic flux vector	○	×	×	1:120 (0.5 to 60Hz:Driving)	20 to 30rad/s	General-purpose motor (without encoder)
Real sensorless vector	○	○	×	1:200 (0.3 to 60Hz:Driving)	120rad/s	General-purpose motor (without encoder)
Vector (FR-A7AP is necessary)	○ (zero speed control, servo lock)	○	○	1:1500 (1 to 1500r/min: Both driving/regeneration)*	300rad/s	General-purpose motor (with encoder) dedicated motor

* Regeneration unit (option) is necessary for regeneration.

2.Long life parts and life check function

(1) Further extended components life

- The life of a newly developed cooling fan has been extended to 10 years of design life. *1 The life of the cooling fan is extended with ON/OFF control of the cooling fan.
- A capacitor with a design life of 10 years*1*2 is adapted and a longer life is achieved. (A capacitor with specification of 5000 hours at 105℃ ambient temperature is adapted.)

*1. Ambient temperature : annual average 40℃ (free from corrosive gas, flammable gas, oil mist, dust and dirt)
Since the design life is a calculated value, it is not a guaranteed value.
*2. Output current: Mitsubishi standard motor (4 poles) equivalent to rated current

- Life indication of life components

Components	Life indication of the FR-A700	Indication of JEMA *3
Cooling fan	10 years	2 to 3 years
Main circuit smoothing capacitor	10 years	5 years
Printed board smoothing capacitor	10 years	5 years

*3. Excerpts from “Periodic check of the transistorized inverter” of JEMA (Japan Electrical Manufacturer’s Association)

2.Long life parts and life check function

(2) State of the art longevity diagnostic method

- Degrees of deterioration of main circuit capacitor, control circuit capacitor, or inrush current limit circuit can be monitored.
- Since a parts life alarm can be output*4 by self-diagnosis, troubles can be avoided.

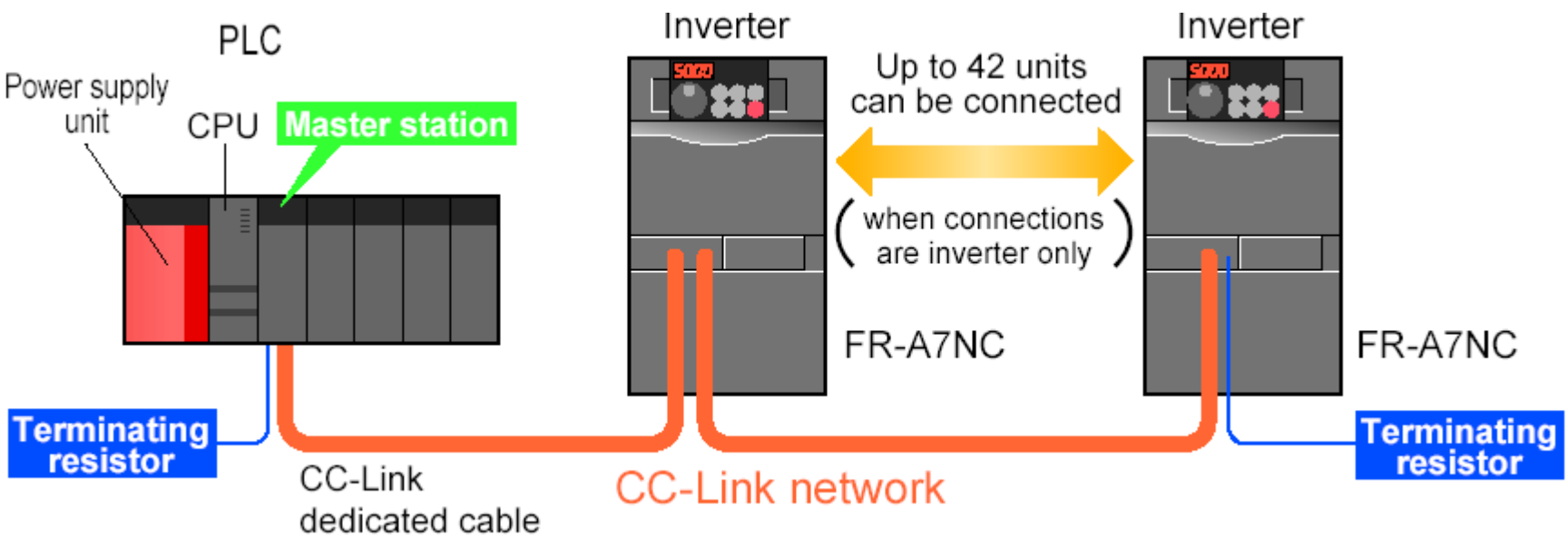
*4. Alarm is output when any of the main circuit capacitor, control circuit capacitor, inrush current limit circuit and the cooling fan reaches the output level.
For the main circuit capacitor, the capacitor capacity needs to be measured during a stop.

3.Network connection as you desired

(1) Complies with the CC-Link communication (option)

FA network

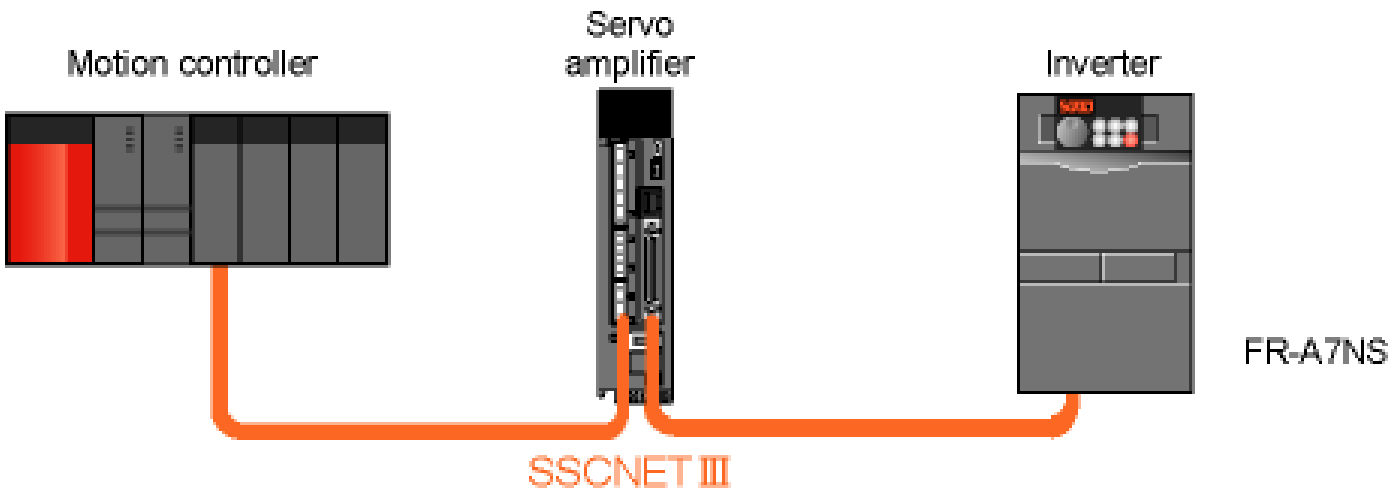
The inverter can be connected with the Mitsubishi PLC (Q, QnA, A series, etc.) through the CC-Link. Complies with the CC-Link Ver.1.1 and Ver.2.0. The inverter operation, monitoring and parameter setting change can be done from the PLC.



3.Network connection as you desired

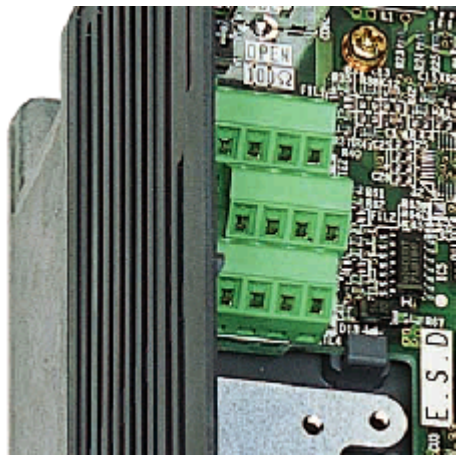
(2) Complies with the SSCNETIII (option, available soon)

The inverter can be connected to the Mitsubishi motion controller through the SSCNETIII. The SSCNETIII employs a high speed synchronous serial communication system and is appropriate for the synchronous operation. (SSCNET・・・Servo System Controller Network)



(3) RS-485 communication

- The RS-485 terminals are available as standard in addition to the PU connector. RS-485 communication can be performed using the operation panel or parameter unit.
- Since the inverter can be connected to the network with terminals, multi-drop connection is also easily done .
- Modbus-RTU (Binary) protocol has been added in addition to the conventional Mitsubishi inverter protocol (computer link).



(4) Complies with main networks overseas

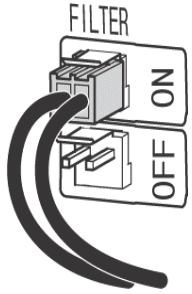
When communication options are connected, the inverter complies with networks such as Device-NET™, PROFIBUS-DP, LONWORKS, EtherNet (available soon) and CANOpen (available soon).

4.Free of environmental worries

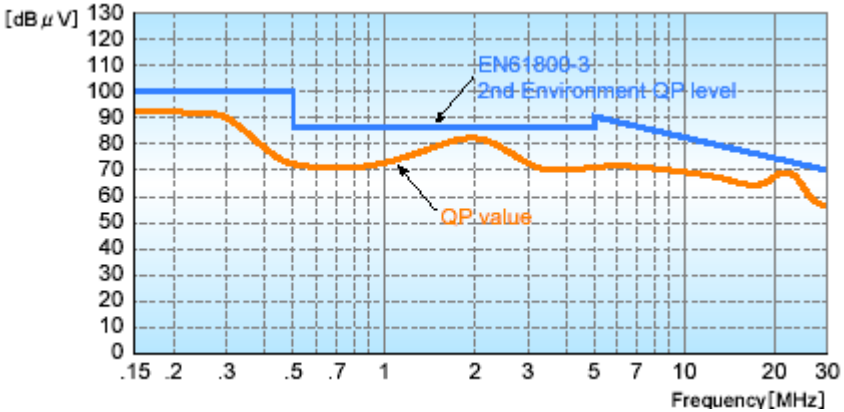
Enhanced noise measures

(1) Reduction of electromagnetic noises

- Inverter noises have been reduced with the adoption of new technology.
- Since a newly developed noise filter (EMC filter) is built-in, a single inverter complies with the EMC Directive (2nd Environment *3).
  (To make the EMC filter of the inverter valid*1, set ON/OFF connector*2 to ON.)



*1 Leakage current will increase when the EMC filter is selected.
*2 Since the leakage current when using the EMC filter for the 200V class 0.4K and 0.75K is small, the filter is always valid (a setting connector is not provided).
*3 Refer to the EMC instruction manual for compliance conditions.



	Capacitive filter	Zero-phase reactor	DC reactor
55K or less	Standard (built-in)	Standard (built-in)	Option (sell separately)
75K or more	Standard (built-in)	Option (sell separately)	Standard (supplied)

4.Free of environmental worries

(2) Measures against harmonic leakage current

- A compact AC reactor (FR-HAL) and a DC reactor (FR-HEL) which limit harmonics current flowing into the power and improve the power factor are available as options. (A DC reactor is supplied with the 75K or more as standard.)
- A high power factor converter (FR-HC, MT-HC) which is very effective (conversion factor K5=0) in suppressing power harmonics can be connected.

AC reactor (FR-HAL)

DC reactor (FR-HEL)

(3) Equipped with inrush current limit circuit

Because of the built-in inrush current limit circuit, the current at power on can be restricted.

(4) Measures against surge voltage

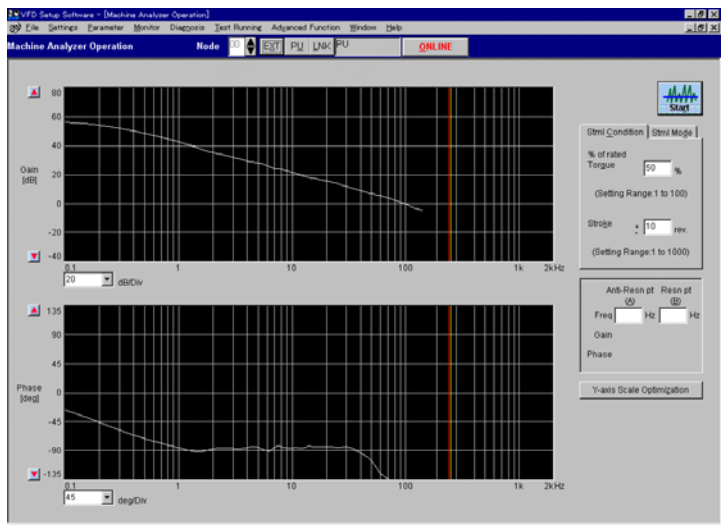
A compact surge suppression filter (FR-ASF,MT-BSC/BSL option) suppresses surge voltage applied to the 400V class motor is provided.

5.Simple operation and easy maintenance

Easy

(1) Easy maintenance with FR-Configurator (available soon)

- Parameter management (parameter setting, file storage, printing) is easy.
- Maintenance and setup of the inverter can be done from a personal computer connected with USB (Ver.1.1).
- Mechanical resonance is easily avoided with machine analyzer function.
- Parameter setting after replacement of the FR-A500 series can be made with a parameter automatic conversion function .

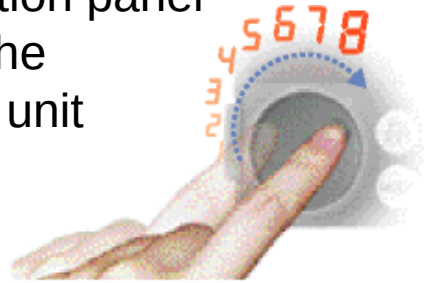


MELSOFT

5.Simple operation and easy maintenance

(2) Operation panel with the popular setting dial

- Possible to copy parameters with operation panel
  Parameter setting values are stored in the operation panel and optional parameter unit (FR-PU07).



Example of parameter change

- Operation is easy with the setting dial.
- Operation panel is detachable and can be installed on the enclosure surface.(cable connector option is required)
- PU/EXT (operation mode) can be switched with a single touch.
- A dial/key operation lock function prevents operational errors.

PU/EXT operation mode example

5.Simple operation and easy maintenance

(3)New type parameter unit FR-PU07 (option, available soon)

- An operation panel can be removed and a parameter unit can be connected.
- Setting such as direct input method with a numeric keypad, operation status indication, and help function are usable. Eight languages can be displayed.
- Since a battery pack is connectable, parameter setting and parameter copy can be performed without powering on the inverter.
- Parameter setting values of maximum of three inverters can be stored.

(4) Easy replacement with the cooling fan cassette

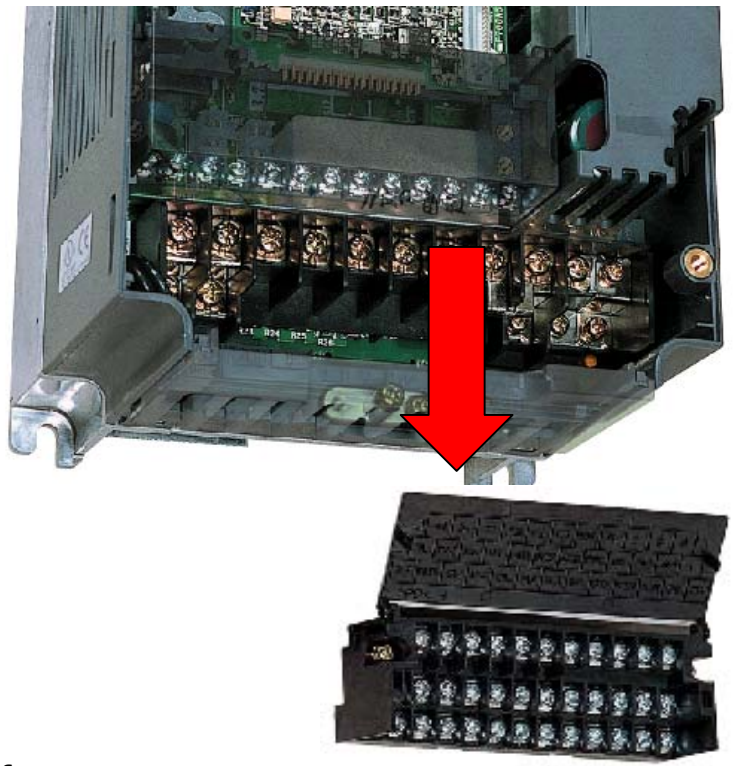
Cooling fans are provided on top of the inverter.
Cooling fans can be replaced without disconnecting main circuit wires.

5.Simple operation and easy maintenance

(5) Removable control circuit terminal block

A removable control circuit terminal block was adapted.

(The terminal block of the FR-A700 series is compatible with that of the FR-A500 series. Note that some functions of the FR-A700 series are restricted when using the terminal block of the FR-A500 series.
Note that the wiring cover is not compatible.)



(6) Combed shaped wiring cover

Since a wiring cover can be mounted after wiring, wiring work is easily done.

6.Improved usability with full of useful functions

(1) More advanced auto tuning

Tuning accuracy equivalent to that of the conventional tuning of “with rotation mode” is realized with the auto tuning without motor running.
Even for the machine which disallows a motor to run during tuning, the motor performance can be maximized.
The sophisticated auto tuning function which measures circuit constants of the motor enables the inverter to perform real sensorless vector control and vector control with all kinds of motor.

(2) Built-in brake transistor (22K or less)
(0.4K to 7.5K built-in brake resistor)

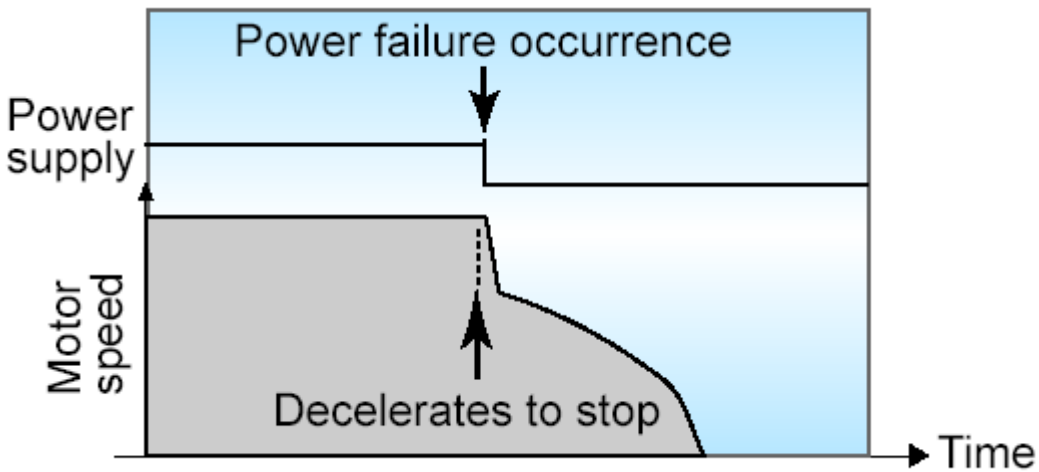
In addition to the 0.4K to 7.5K, a brake transistor is built-in to the 11K, 15K, 18.5K and 22K.

For the 11K to 22K, a brake transistor (option) can be also connected.

6.Improved usability with full of useful functions

(3) Power-failure deceleration stop function/instantaneous power-failure operation continuation function

- The motor can be decelerated to a stop when a power failure or undervoltage occurs to prevent the motor from coasting. For fail-safe of machine tool, etc., it is effective to stop the motor when a power failure has occurred



- Since the original operation continuation at instantaneous power failure function has been newly adopted, the motor continues running without coasting even if an instantaneous power failure occurs during operation.
  *The inverter may trip and the motor may coast depending on the load condition.

6.Improved usability with full of useful functions

(4) Regeneration avoidance function

For operations of such as a pressing machine, in which an instantaneous regeneration occurs, overvoltage trip can be made less likely to occur by increasing frequency during regeneration.

(5) Pulse train I/O function

Speed command by pulse train signal from the controller etc. can be directly input to the inverter. Since pulse can be output from the inverter at the same time, synchronous speed operation of inverters can be performed. (maximum pulse input 100kpps, output 50kpps)

(6) Enhanced I/O function

- For the analog input terminal (two points), you can switch between voltage (0 to 5V, 0 to 10V) and current (0 to 20mA).
- Possible to display the ON/OFF status of the I/O terminals on the operation panel.
- Two points relay output is available.

7.Global compliance

(1) Complies with UL, cUL, EN (LVD) as standard

(2) Sink/source logic can be switched with a single touch

(3) Wide voltage range

Compatible with both 240V power supply (55K or less) and 480V power supply as standard